

WE have received the annual report for 1885 of the Russian Geographical Society, which contains short accounts of the expeditions of M. Prjevalsky to Central Asia, M. Potanin to China, M. Grum-Grzimailo in the sub-Pamir region, MM. Wolter and Trusman; and the usual notices on works for which the medals of the Society were awarded. Geographers surely will be sorry not to find in this report any notice of the work done by the Caucasian and Siberian branches of the Society, which usually so greatly increases the value of the annual report of the Russian Geographical Society.

WE are glad to learn from the last Annual Report of the Russian Geographical Society that the Appendix to the *Russian Gazetteer*, by P. P. Semenoff, is in course of preparation. The full edition of the observations at the Polar Stations on Novaya Zemlya and on the Lena; the remarkable collection of maps dealing with the delta of the Amu-daria, Baron Kaulbars; and a geological map of the shores of Lake Baikal, are also in preparation.

At the last meeting of the Paris Geographical Society, Dr. Maurel read a paper on his travels in Cochinchina and Cambodia, on a mission from the Minister of Public Instruction. By means of a series of maps representing the Indo-Chinese peninsula in the seventh, eleventh, eighteenth, and nineteenth centuries, he showed the relative importance at different epochs of each of the peoples inhabiting this region. He then gave a general account of the country, its geography, climate, population, &c. A large collection of ethnographical objects which he had with him added much interest to that part of his paper. The young Cambodians at present being educated in Paris were present, clothed in the national costume.

#### THE DETERMINATION OF THE INDEX OF REFRACTION OF A FLUID BY MEANS OF THE MICROSCOPE

OF the various means adopted hitherto for the determination of the refractive index of a fluid, the most usually adopted has been that of the hollow prism, telescope, and collimator.

This method involves (a) the determination of the angle of the prism; (b) the position of minimum deviation; (c) the use of monochromatic light, if errors arising from the different dispersive qualities of the substances are to be avoided. These preliminaries render the labour of determining the index a very difficult task, and the observer will scarcely expect to accomplish more than one observation at a sitting.

Cleaning the prism is not the least of the troubles, and when we add to them the fact that many liquids are so opaque that sufficient light can scarcely be passed through them for the observation, it is not surprising that so few have been found to possess the courage necessary for attacking the problem. The writer having had occasion for frequent determination of the index of refraction, has found the use of the microscope far surpasses the usual method in giving results of the greatest delicacy combined with a minimum of cost and of time.

Starting with the well-known fact, that an object viewed through a medium whose refractive index is different from that of air will occupy a different position from its image, or in the language of the text-books,  $v = u + \frac{t}{\mu}$ , where  $v$  determines the

position of the geometrical focus of a pencil after direct refraction through a plate whose thickness is  $t$ , the writer was led to adopt the following plan.

On an ordinary "slip" as used for mounting preparations for the microscope a delicate mark is made with a writing diamond. A large but very thin "cover-glass" is cut in half, and its pieces cemented to the "slip" on either side of the mark, leaving a space of about one-eighth of an inch; then, resting on these supports, and bridging over the intervening space, is placed a small but very thin "cover-glass," and a drop of the fluid to be examined is run under this.

The fine mark made on the "slip" is now viewed through this with the microscope, using as high a power as possible, for the higher the objective the more delicate will be its focal adjustment; when the object is in focus the position of the "fine adjustment" must be read off. The microscope must then be left, and the slip removed for the examination of any other fluid. The top cover-glass is lifted off, the slip cleaned, the same cover-glass replaced, and a drop of a different fluid run under. Re-

placing now the slip upon the stage, and looking for the mark which was previously in focus, it will be found that an alteration of the fine adjustment is necessary to bring it into focus.

If the medium is of lower refractive index, the objective will have to be lowered, and conversely. Thus a rapid comparison of the relative refractive indexes of two media may easily be made.

But not only can the relative refractive powers of different bodies be thus obtained; the absolute numerical values may with the greatest accuracy be determined. For this it is essential that the fine adjustment screw should have accurate micrometer divisions, and this is usually the case now that immersion objectives are in common use. Two fluids must be selected whose refractive indexes present a wide difference, say oil of cassia and water; focus the mark, first viewed through water, secondly viewed through oil of cassia, and read off the number of divisions the screw has been turned through in the alteration of the focus. The refractive indexes of oil of cassia and water being known from the tables, a numerical value will by the formula be obtained for each division of the screw-head, and thus the absolute numerical index of any medium easily be determined.

By this simple and inexpensive method the writer has obtained from fifteen to twenty absolute indexes in a sitting of an hour's duration.

The importance of obtaining suitable media of high refractive index for mounting objects to be viewed with very high powers cannot be overestimated, for not only is a wider cone of light thus brought to bear upon the object, but its image is advanced, so that a greater working distance is obtained between the front lens of the objective and the cover-glass.

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#### UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The twentieth annual report of the Museums and Lecture-Rooms Syndicate, lately issued, recounts continuous progress in many scientific departments. The number of students attending demonstrations in the Cavendish Laboratory reached 100 last winter, and during the year twelve persons have done original work in the Laboratory.

The Plumian Professor (Mr. G. H. Darwin) introduced a new feature last summer by giving a course of lectures in the Long Vacation, and the attendance (thirteen) was encouraging. Few students attend the Plumian Professor's advanced lectures on the orbits and perturbations of planets.

In mechanism Prof. Stuart reports that the temporary museum and lecture-room has become very insufficient.

In chemistry there has been a considerable increase of students in advanced classes and special departments. The new laboratory is now being vigorously advanced. The classes in mineralogy maintain an average of sixteen students. The acquisition of 250 specimens from Mr. Field's collection has added some minerals previously unrepresented, and has improved the collection considerably for students' use.

In geology Prof. Hughes regrets the disadvantages of his present accommodation for teaching and lecturing, and finds the specimens of value are lost to the Museum because of its inadequate means of displaying them. A valuable collection of Cretaceous Cambridge fossils, many of them type-specimens, has been presented by Mr. James Carter of Cambridge.

Mr. Marr, Fellow of St. John's College, is engaged upon the arrangement of the Foreign and British Cambrian fossils, of which it will be desirable soon to publish a new catalogue. The petrological series has been rearranged, and also the collection of microscope slides. The Upper Jurassic fossils have been largely added to and rearranged. Many interesting additions to the museum are chronicled in the report. It shows how largely the Museum gains from the interest of present and former students at Cambridge.

Prof. Babington has been chiefly occupied with the study of different parts of the Herbarium—especially the magnificent collection of European Rubi—and the identification of plants sent by botanists from a distance. Dr. Vines's students have numbered nearly sixty, and the Botanical Laboratory is inconveniently crowded. The commencement of a botanical museum has been made by Messrs. Potter and Gardiner, with the object

of illustrating the ordinary text-books in the hands of students. Many interesting specimens have been given by Sir Joseph Hooker and Mr. Thiselton Dyer, Messrs. Potter, Vines, Gardiner, Hillhouse, and Miss B. K. Taylor of Girton College.

In the Museums of Zoology and Comparative Anatomy some most useful work has been done by the Strickland Curator (Mr. Gadow) in exhibiting the characteristic parts of birds, labelled and illustrated by printed descriptions. A lecture-room for animal morphology is urgently required. The attendances in the Lent Term this year were:—Elementary Biology, 163; Elementary Morphology, 94; Advanced Morphology, 16; total 273. Besides the two lecturers, nine graduates and advanced students took part in demonstrating to the classes. Prof. Macalister reports that the new iron dissecting-room has been very satisfactory, and far more anatomical work has been done than ever before in the University.

The number of students in the elementary physiology classes have averaged 130 each term; while an average of over 30 attended advanced lectures. In pathology Prof. Roy has given systematic lectures on general pathology, a demonstration course on morbid anatomy, a practical pathology course, morbid histology classes, &c., and has found it necessary to engage Mr. Joseph Griffiths, M.B. Edin., as his assistant. Space and other accommodation being deficient hampers the extension of the work.

Vigorous work in natural science will go on during July and August. Mr. Fenton will give a course of chemistry, and the University and Cavendish Laboratories will be open. Mr. Potter will lecture on systematic botany with practical work. Repetition classes in histology and physiology will be given by a demonstrator, and Dr. Hill will conduct a class for practical histology. Prof. Macalister will give demonstrations in osteology; and other lectures will be given regularly in connection with the medical school by Prof. Humphry, Prof. Roy, Dr. Anningson, Dr. Ingle, &c. The courses will begin from July 7 to 12.

Mr. W. H. Caldwell, Fellow of Caius College, and Balfour Stuart, having returned to Cambridge from Australia with a large supply of valuable material, asks for a room in which to prosecute his original researches. This it is proposed to supply at a cost of 110*l.* on the roof of a portion of the Museum Buildings.

### SCIENTIFIC SERIALS

*American Journal of Science*, May.—The columnar structure in the igneous rocks on Orange Mountain, New Jersey, by Joseph P. Iddings. This paper, read before the Philosophical Society of Washington, June 1885, deals especially with the large vertical columnar formations of O'Rourke's Quarry south of Llewellyn Park, and with the still more interesting case of curving and radiating columns in the Undercliff Quarry near the north gate of the same park. These lava sheets are studied in connection with the general theory of columnar formation, which is attributed to a cracking produced by the shrinkage of the mass upon further cooling after it has consolidated into rock, which still retains a great amount of heat. As the consolidation due to surface-cooling proceeds inward, the resistance to contraction parallel to the surface increases at a greater rate than that normal to it, a point may then be reached where resistance in the first-named direction will exceed that in the second, and the resulting rupture will be *perpendicular* to the cooling surface. The wavy form of some of the columns in Orange Mountain suggests irregularities in the mass which disturbed the uniform advance of the lines of maximum strain, and caused them to deviate from parallelism.—Larval theory of the origin of tissue, by A. Hyatt. This is an abstract of a paper published in the *Proceedings of the Boston Society of Natural History* (1884), in which an attempt is made to trace a phyletic connection between Protozoa and Metazoa, and also to show that the tissue-cells of the latter are similar to asexual larvæ and related by their modes of development to Protozoa, just as larval forms among the Metazoa themselves are related to the ancestral adults of the different groups to which they belong. In the abstract the suggestion is added that Volvox and Eudorina are true intermediate forms entitled to be called Mesozoa or Blastrea. The author's conclusions bear directly on the results already obtained by Semper, Dohrn, and others in tracing the origin of the vertebrates to some worm-like type.—Cretaceous metamorphic

rocks of California, by George F. Becker. During a recent investigation of the Californian quicksilver deposits by the United States Geological Survey, the crystalline and serpentinite metamorphic rocks of the coast-ranges have been subjected to an elaborate examination. Pending a complete report, a summary of the results is given in the present paper, all detailed proofs being deferred until final publication. The field-work was carried out by the author and Mr. H. W. Turner, the chemical analyses by Dr. W. H. Melville; and the microscopical examinations jointly by the author and Mr. Waldemar Lindgren. The question of metamorphism has perhaps never before been studied under more favourable conditions: a solid basis has been obtained for further inquiry, while the results already secured are sufficiently definite to form an important aid for the investigation of metamorphic areas in other geological regions. One important result is the full confirmation of von Rath and Bischof's views regarding the probable conversion of feldspar into serpentine. There seems to be no doubt that the phenomenon occurs in the Californian coast-ranges where the feldspars are corroded externally, cracks widened irregularly and filled with serpentine, and in some cases elongated teeth of serpentine may be seen biting into the clear feldspathic mass. It is impossible to explain these and many similar occurrences, except on the supposition that a reaction between some fluid and the feldspars has yielded serpentine. Quartz also, which is well known to be sometimes converted into talc, is in the same region transformed into serpentine.—Arnold Guyot, by James D. Dana. This is a biographical sketch of the distinguished Swiss naturalist, brought down to the year 1848, when he settled in the United States.—On the determination of fossil dicotyledonous leaves, by Lester F. Ward. The writer offers some critical remarks on the views, and especially on the system of nomenclature, advocated by Dr. A. G. Nathorst of Stockholm in a paper on fossil floras recently published by him in the *Botanisches Centralblatt* (xxvi., 1886).—Pseudomorphs of limonite after pyrite, by Erastus G. Smith. It is shown that the common hydrated oxides of iron generally referred to limonite are undoubtedly alteration products of ferrous oxide, or decomposition-products of other iron-bearing minerals. Their secondary nature is clearly shown in the various occurrences where crystalline form is yet retained, giving clearly-defined pseudomorphs of ferric hydrate after the original mineral. An interesting case is described of such an alteration of pyrite into ferric hydrate, in which the crystalline form of the pyrite is sharply defined.—Influence of motion of the medium on the velocity of light, by Albert A. Michelson and Edward W. Morley. A series of important investigations are described, tending fully to confirm Fizeau's classical experiment of 1851, which proved that the luminiferous ether is entirely unaffected by the motion of the matter which it permeates.—Note on the structure of tempered steel, by C. Barus and V. Strouhal. The results are given of some experiments on the structure of steel, a full report on which will appear in *Bulletin* No. 35 of the U.S. Geological Survey.—Brookite from Magnet Cove, Arkansas, by Samuel L. Penfield. A description is given of a fine crystal of brookite from the collection of Prof. G. J. Brush. It belongs to the variety classed as arkansite by C. A. Shephard.

*Bulletin de l'Académie Royale de Belgique*, March 6.—Determination of the direction and velocity of the motion of the solar system through space, by M. P. Ubachs. So far from being a constant quantity, the systematic aberration of the sun and its satellites was already shown to vary with time in right ascension and declination. It was also seen that, by taking into account this fact in studying the motion of the solar system, it might be possible to determine not only the direction and velocity of the motion, but also its extent and even the mean distance of the stars selected for the purpose of comparison. The author here undertakes to apply the principle to certain groups of stars of like magnitude, and although the results are not absolutely uniform, the agreement is sufficiently close to justify the conclusion that theory and practice are, on the whole, in harmony. The direction of the motion has been somewhat accurately determined, but the mean velocity expressed by the fraction 0.109 of the mean radius of the earth's orbit would appear to be far less than that usually attributed by astronomers to the motion of the solar system.—On the study of "arithmetical events," by M. E. Cesàro. In explanation of the expression "arithmetical events," this young and profoundly original mathematician remarks that the systems with which he is here occupied are constituted by numbers taken at hap-hazard. When such a system happens to